tween phosphorus pentachloride and ammonium chloride; it is a substance almost as stable as the triple compound, and yields on saponification the acid $(PNO_2H_2)_4$, which is likewise a stable body. Moreover, the acid corresponding to the triple compound has been isolated, and also a higher chloride $(PNCl_2)x$ of an oily character, and whose molecular weight has not yet been ascertained. In describing his repetition of Dr. Gladstone's work, Mr. Stokes incidentally mentions the interesting circumstance that the triple compound readily forms enormous crystals, well-developed prisms several inches long and of considerable thickness being frequently deposited from benzene, and indeed their size appears only to be limited by that of the containing vessel and the bulk of solution. These crystals melt at 114°. The quadruple compound melts at 123°·5, and boils at the normal pressure at 256°·5. It crystallises well in colourless prisms, which are usually much smaller than those of the triple compound, and exhibit great tendency to develop an acicular character. It is less soluble in alcohol and benzene than the latter compound; it may be recrystallised from glacial acetic acid, but it exhibits a great aversion for water, not being wet by it, and consequently the crystals float on water. It dissolves in hot concentrated oil of vitriol, but upon boiling most of it sublimes unchanged, an evidence of its great stability. Its vapour is endowed with a pleasant aromatic odour, but inhalation of more than traces is followed in two or three hours by alarming difficulty in breathing and persistent irritation of the air passages. Its vapour density was determined in an atmosphere of hydrogen, and indicated the quadruple formula. Even boiling water exerts only a very slight action upon it; but a smooth decomposition is effected by dissolving in ether, and repeatedly agitating with water. The acid produced is deposited from the water in crystals having the composition $(PNO_2H_2)4 + 2H_2O$. This interesting acid readily decomposes soluble chlorides, nitrates, and sulphates, forming three series of salts, in which respectively one-fourth, one-half, and all the hydrogen is replaced by the metal. The free acid is so highly stable that it may be boiled for hours with nitric acid or *aqua regia* without decomposition. Further details concerning it, and the other compounds isolated, will shortly be published.

BIOLOGICAL WORK ON THE ILLINOIS RIVER.

ILLINOIS possesses a good Laboratory of Natural History, in which Prof. S. A. Forbes, with a number of assistant entomologists and zoologists, carry on investigations of value to science and the State. A report on the work of the Laboratory during the past two years has recently been issued. To us the points of special interest with which it deals are (1) the establishment, in 1894, of a biological station for the continuous investigation of the aquatic life of the Illinois River, and its dependent waters, near Havana; and (2) an elaborate experimental research carried on during the past year to determine means for the destruction of the chinch bug, and especially for the dissemination of the contagious diseases of that insect. This investigation was undertaken by the Laboratory staff, with the co-operation of the State Agricultural Experiment Station.

We have already noted the establishment of the biological station (NATURE, vol. l. p. 275, 1894), but as it is the first inland aquatic biological station in America, manned and equipped for continuous investigation, the following further details are interesting. By the kindness of Prof. Forbes, we are able to illustrate the description with two of the fifteen fine process plates contained in his report.

The Station was opened just a year ago. Its general objects are to provide additional facilities and resources for the study of the natural history survey of the State, now being carried on by the State Laboratory of Natural History; to contribute to a thorough scientific knowledge of the whole system of life existing in the waters of this State, with a view to economic as well as educational applications, and especially with reference to the improvement of fish culture and to the prevention of a progressive pollution of Illinois streams and lakes; to occupy a rich and promising field of original biological investigation hitherto largely overlooked or neglected, not only in America but throughout the world; and to increase the resources of the zoological and botanical departments of the University of Illinois, by providing means and facilities for special lines of both graduate and undergraduate work and study, for those taking major courses in these departments.

The Station differs from most of the small number of similar stations thus far established in the United States, in the fact that its main object is investigation instead of instruction, the latter being a secondary, and at present an incidental, object only. It has for its field the entire system of life in the Illinois River and connected lakes and other adjacent waters, and it is Prof. Forbes' intention to extend the work as rapidly as possible to the Mississippi River-system, thus making a beginning on a comprehensive work in the general field of the aquatic life of the Mississippi Valley, in all its relations, scientific and economic.

The special subject which Prof. Forbes fixed upon as the point of direction towards which all the studies shall tend, is the effect, on the aquatic plant and animal life of a region, produced by the periodical overflow and gradual recession of the waters of great rivers, phenomena of which the Illinois and Mississippi rivers afford excellent and strongly marked examples. This field of research is entirely fresh, and at the same time is highly interesting and important.

As an incidental, but by no means unimportant, result of the work, material will be accumulated for a comparison of the chemical and biological conditions of the waters of the Illinois River, at the present time, and after the opening of the Chicago drainage canal.

The practical importance of the undertaking, as affording the only sound basis for a scientific fish culture, will be fully recognised by all who are seeking to apply scientific methods of investigation to economic problems.

It is pointed out that the Station will also serve as a centre of interest and activity for University students engaged on zoological and botanical subjects. Not many years ago biological instruction in American colleges was mostly derived from books; of late it has been largely obtained in laboratories instead; but Prof. Forbes believes that the mere book-worm is hardly narrower and more mechanical than the mere laboratory grub. Both have suffered, and almost equally, from a lack of opportunity to study nature alive. One knows about as much as the other of the real aspect of living nature, and of the ways in which living things limit and determine each others' activities and characters, or in which all are determined by the inorganic environment.

Means are provided by which students, and intending teachers of biology, may be given a wider knowledge of their subject, and where they may investigate experimentally the problems of mutual influences and relationship in the living world.

Possibly still more important is the opportunity which the Station will offer, when permanently established and fairly well developed, to the independent student and investigator, zoological or botanical, who may desire to pursue his studies in the field covered by the operations. It is a part of the plan of organisation and equipment to receive and assist in every practicable way advanced students and investigators of this description, from whatever place they may come.

Havana was selected as the site of the Station because of several unique advantages offered by that locality. Streams and lakes illustrating practically all the typical Illinois River situations are to be found there, convenient of access from a central point, and from each other. An extensive sandy bluff, commonly well shaded and oozing spring water at its foot, borders the river bottom on the east, and introduces several unusual features of interest to the œcologist, besides affording a clean and hard shore to work from, dry, shady, and well-drained camping ground, and an abundance of very pure cold water at all times of the year.

A "cabin boat" was used as a field headquarters, and stationed on Quiver Lake, two and a half miles above Havana. It carried the seines, sounding lines, aërial and aquatic thermometers, dredges, surface nets, Birge nets, insect nets, plankton apparatus, and other collecting equipment, together with microscopes, reagents, a small working library, a large number of special breeding cages for rearing aquatic insects, and a few small aquaria. This boat was provided with sleeping accommodation for four men, and with a well-furnished kitchen.

The greater part of the field work was done on seven regular stations, visited periodically throughout the year; two on the

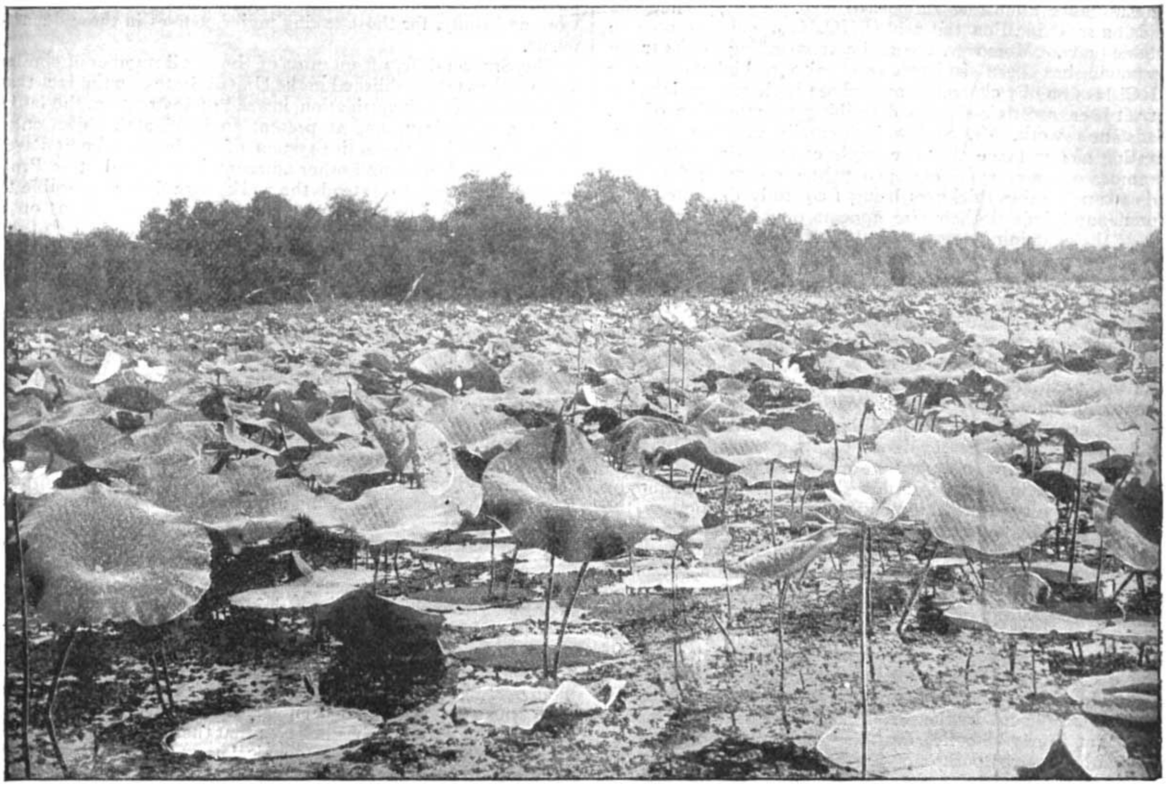

FIG. 1.—Lotus Bed, near Head of Quiver Lake, West Side.

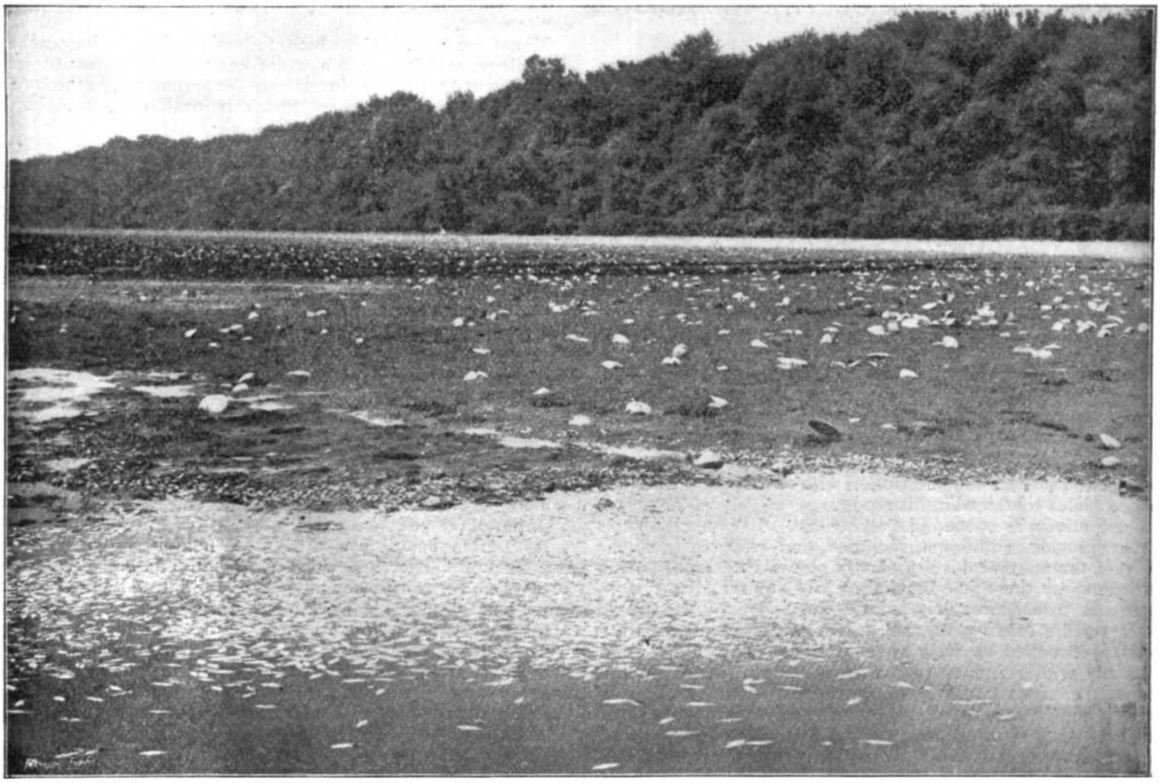

FIG. 2.—Dead Fish and Mussels. Bed of Phelps Lake.

Illinois River, three on Quiver Lake, and one each on Phelps and Thompson's Lakes.

Quiver Lake (Fig. 1), in which the headquarters' boat was placed, is an abandoned portion of the old bed of the river. It varies in length (when the water is low enough to define it clearly) from one and a half to two and a half miles, and has a usual width of about five hundred feet at low-water mark. It lies nearly parallel with the main river, into which it opens, even in the lowest stage of water, at its lower or southern end, by about half its greatest width.

Thomson's Lake lies wholly within the bottom lands of the main river, and its banks are consequently everywhere low and flat. It is five miles in length by about half a mile in width at an average midsummer stage. Neither this nor Quiver Lake ever goes dry, the water in the deepest places being not less than three and a half or four feet during the dryest seasons. Phelps Lake (Fig. 2), on the other hand, is a pond about half a mile long by a fourth as wide, having neither inlet nor outlet after the overflow has receded, rarely drying up entirely, but not infrequently being reduced to a few shallow pools. It is completely surrounded by a bottom-land forest, and its bed is a mere shallow depression in the mud.

The results of the first season's work are, of course, but just beginning to appear. Indeed, the problems to be solved in such situations have scarcely more than dimly shown themselves as yet, but the promise is nevertheless already very interesting. Notable contrasts in kind and number appear between animals of the springy shore of river or lake, and those of the muddy bottom, only a few rods away on the other side; between river and lake; between Quiver and Thompson's Lakes; between each of these and Matanzas Lake; and between all the other lakes and the temporary pond distinguished locally as Phelps Lake—contrasts sometimes easily comprehensible; and sometimes peculiarly puzzling, like that between Quiver Lake on the one hand, the waters of which are choked in midsummer with a dense growth of aquatic vegetation, but contain fewer of the smaller animal forms (Entomostraca, and the like) than the open current of the river itself, and Thompson's Lake, on the other hand, where the water is relatively clear of aquatic plants but abounds in rotifers and Entomostraca. Still more curious is the contrast between the similarly situated and very similar lakes, Quiver and Matanzas, the waters of one loaded and clogged with plants, and swarming with small molluscs and insect larvæ, and those of the other with scarcely a trace of even microscopic vegetation, and with a correspondingly insignificant quantity of animal life.

One surprising result is the abundance of minute life in the main stream, which sometimes contains a greater abundance of animal forms than most of the lakes connected with it; and another is the relatively small difference between the animals frequenting widely unlike situations in the same body of water. A large number of new forms were found, especially among rotifers, worms, and insect larvæ. The collections of the season, preserved for detailed study, are included under nine hundred and fifty-eight collection numbers, representing as many different lots of specimens. In connection with these, Prof. Forbes and his assistants are now engaged upon determination work and other laboratory studies, and the preparation of reports. The papers and reports embodying these studies will be printed in the *Bulletin* of the Illinois State Laboratory of Natural History. So far as possible, each general taxonomic paper will be preceded by a thoroughly practical synopsis of genera and species, illustrated by figures of typical forms, and intended to open up to the student and teacher of natural history in Illinois many interesting and important parts of the local zoology.

THE VARIETIES OF THE HUMAN SPECIES.[1]

In man, as in other animals, we find physical characteristics of two kinds, external and internal. The first are principally those pertaining to the cutis and certain cutaneous appendages, and include the colouring of the skin and hair, the structure and form of the hair, and also the colouring of the eyes. The chief internal characteristics are the bones from which the form and figure of all the members are taken, as well as those of the separate parts of the body clothed with soft tissues, such as muscles and fat. The cranium is the most important and most characteristic part of the entire human skeleton.

The cranium is a bony case which encloses a viscus of the first order, the brain, which in man is, in relation to the animal series, better developed, both in its forms and functions. It is known that the brain and cranium, from the embryological to the adult state, are in a parallel manner and gradually connected in evolution, and the external form of the one corresponds to that of the other. Most certainly it is not the cranium which gives form to the brain of man; it is more probable that it is the brain which moulds its organ of protection. Given hereditary conditions, we may affirm that the form of the cranium is correlative to that of the brain. If we could discover why the brain takes or has taken different forms, we would possibly understand better its correspondence with the exterior structure of the cranium by which it is surrounded. We might be able to learn also what functional and especially what psychological characteristics are united to the cerebral forms which are revealed by cranial forms. All that is obscure for us, and also unexplored, because unsuspected; for in place of that, and in an inexact manner, the volume has been taken into account, and therefore the weight of the brain, as being the only means of making an anthropological diagnosis of its functional value, the volume and weight corresponding to the capacity of the cranium.

But besides the cranium commonly called cerebral, there is the face, which, from the morphologic point of view, is not less important. The face has generally given more positive means for distinguishing human groups, not only on account of the colouring of the skin, but on account of the form and disposition of its parts, of the nose, of the cheeks, of the molar teeth, and on account of other characteristics which, when considered together, disclose differences not immediately revealed by the cerebral cranium.

The other parts of the skeleton also have differences more or less profound in the different ethnic groups, the stature, the length of the extremities both absolutely and relatively to the stature and to the trunk; the thoracic form, and so on. But such differences are but slightly characteristic in comparison to those presented by the cranium and the face; until now, moreover, they have had but slight value, the reason being that they are derived from characteristics which are merely secondary.

We are ignorant what may have been the primitive type or the primitive human types, considered in all their internal and external characteristics; that is, what skeletal forms certain ethnic groups of differently coloured skin possessed; or, on the other hand, what colour of skin and hair belonged to certain skeletal forms. That difficulty is caused by a fact easy to understand, by the mingling of different types among each other, and by the hybrid forms from which man is derived. It is true, however, that certain hybrid results seem to be limited to certain regions and to a few human groups; and that, on account of this, the elements which have furnished such products may be learned up to a certain point; but in the beginning, at least, it will be necessary to learn the structures of the parts from which hybrids are derived.

It is impossible not to admit human hybridism, since it is demonstrated clearly by all anthropologists; in this direction America alone shows us a perfect example of experimental anthropology. It has been determined from observations that human hybridism is multiform among all peoples; but what we learn from the facts relates to the exchange of external characteristics and their mixture with those internal, that is, the union of the external characteristics of one ethnic type with the internal characteristics of another type. Thus, one may observe the colour of the skin and hair with its special form united to characteristics of skeletons which do not generally belong to types of that colour, and *vice versâ*. That may be observed concerning certain characteristics, and not of all; such as the stature, or the face, with its soft covering, or the form of the cranium only.

If we study our European populations which are called white, but which have many gradations of whiteness, we may note the great mixture of characteristics, a mixture which is changeable, from which results a great variety of forms of individual types, constituted of characteristics differing from each other. An analysis must be very accurate and very minute to discriminate these different elements which exist in the composition of the ethnic characteristics of individuals

---

[1] Extracted from a translation of Prof. Giuseppe Sergi's "Le Varietà Umane." published by the Smithsonian Institution.